bodies in the visible spectrum. Two experimental methods were used:—(1) The author's "elliptic analyser," described by Dr. Zakrzewski in 1907, and used since with success by Herr Volke; as shown in the paper, this arrangement provides a comparatively exact way for the determination of the refractive index ν and of the index of extinction κ for a metallic body. (2) A new scheme depending on the use, for the observation of ellipticity, of a convergent pencil of light; the results thus obtained are estimated to be correct within 5 per cent. of their values. Illustrative results for platinum, cobalt, and graphite are adduced. Maxwell's simple equation $\nu^2-\kappa^2=$const., now given up on theoretical grounds, is found to hold true for graphite. The second correlative equation, however, asserting the proportionality of the product $\nu\kappa$ with the period of vibration in the incident beam of light, does not agree with the observations.

An interesting address on "Comets and Electrons" was delivered by Prof. Augusto Righi to the Bologna Academy on June 22, and is published as No. 13 of *Altualità scientifiche* (Bologna: Nicola Zanichelli, 1910, price 2.50 lire). In the paper Prof. Righi traces the growth and development of ideas regarding radiation-pressure, the successive proofs, disproofs, and reproofs of its existence for finite bodies, for minute solid particles such as are believed to exist in comets' tails, and for gaseous molecules, the theory of formation of the tails themselves, the electrical phenomena accompanying them, the escape of gases from planetary atmospheres, the nature of sun-spots and allied astrophysical phenomena. Prof. Righi, in conclusion, refers to the experiments conducted during the passage of the earth through Halley's comet, a large proportion of which gave rise to no definite conclusions. The following suggestive remark occurs in the paper:—"In this connection of the action of radiations on the individual molecules of a gas, and hence on the presence of gases in comets' tails, there has been once more verified the not uncommon fact that conclusions which are just, or regarded as such, are reached only by an asymptotic method, that is, after a series of successive corrections, and often, as in the present case, after having completed a series of successive oscillations, fortunately of decreasing amplitude, from one side to the other of the truth."

A committee was appointed about two years ago by the Institution of Civil Engineers to investigate and report on questions connected with the use of reinforced concrete. A preliminary and interim report has now been issued giving information regarding the conditions under which reinforced concrete has been employed in engineering work in various countries, and the views of engineers having special experience in its use. The committee does not accept any responsibility for any of the statements contained in the report, and reserves its own views and recommendations until later. Hence the designer will still have to depend largely on the excellent report presented some time ago by the Royal Institution of British Architects, more especially as he will find difficulty in extracting definite information from the present report. The reader is expected to compare for himself the various statements of opinions contained in 262 pages of letterpress. The committee is now engaged upon tests and investigations in order to enlarge the knowledge at present available, and no doubt more definite information and conclusions will appear in a subsequent report.

Messrs. Newton and Co. have been granted a warrant of appointment as opticians to the King. They have held Royal warrants for more than sixty years.

OUR ASTRONOMICAL COLUMN.

Ephemeris for Faye's Comet, 1910*e*.—Dr. Ebell publishes a continuation of the ephemeris for Faye's comet in No. 4457 of the *Astronomische Nachrichten*; the following is an extract:—

Ephemeris 12h. (Berlin M.T.).

1910	α (true) h. m.	δ (true) ° ′	log r	log Δ	mag.
Dec. 6	3 37·1	+3 44·0	0·2270	9·8717	10·3
,, 10	3 37·6	+3 25·0	0·2292	9·8845	10·3
,, 14	3 38·5	+3 12·8	0·2316	9·8985	10·4
,, 18	3 39·8	+3 7·1	0·2342	9·9134	10·5
,, 22	3 41·6	+3 7·5	0·2371	9·9290	10·6
,, 26	3 43·7	+3 13·3	0·2401	9·9453	10·7
,, 30	3 46·3	+3 24·1	0·2433	9·9621	10·8

This ephemeris is calculated from Prof. Stromgren's elements with a correction ΔM., and the time of perihelion is brought forward by about +8·91 days, to November 1·647 (Berlin M.T.); an observation at Teramo on November 23·4 gave a correction of −9s., −2·1′, to the ephemeris position.

Recent Helwan Photographs of Halley's Comet.—Halley's comet was again photographed with the Reynold's reflector at the Helwan Observatory on November 7, 9, and 11, and the plates indicate a correction of +0·2m., 0′, to the ephemeris published in No. 4450 of the *Astronomische Nachrichten*; the magnitude is estimated at about 14·5.

A telegram from Prof. Frost announces that Prof. Barnard observed the comet (presumably with the 40-inch refractor) at the Yerkes Observatory on November 11 at 17h. 17·8m. (M.T. Yerkes), and found its magnitude to be about 11·0; the observed position was

R.A. = 12h. 4m. 21·3s., dec. = −14° 54′ 15″.

From these observations it would appear that there is a marked difference between the photographic and visual magnitudes, and, curiously enough, it seems that the visual brightness is the greater (*Astronomische Nachrichten*, No. 4457).

The Total Eclipse of the Moon on November 16.—Some interesting notes dealing with observations made during the recent eclipse of the moon appear in No. 21 of the *Comptes rendus* (November 21). MM. Luizet, Guillaume and Merlin, at the Lyons Observatory, observed the occultations of several stars, and found that in some cases the disappearances were not instantaneous. In two cases the star appeared to be projected on the disc before disappearing, and in one case contact with the limb preceded disappearance by three seconds. On the other hand several well-observed occultations and reappearances were quite sudden.

M. Montangerand, Toulouse Observatory, noted that in one case the extinction took an appreciable time, but in two others it was instantaneous; he also directs attention to the apparent unevenness of the shaded disc. M. Lebeuf, at Besançon, also noted this phenomenon, and describes the apparent rotation of the deeper coloration as the eclipse proceeded. The general transparency of the shadow, as compared with earlier eclipses, notably that of April 11, 1903, also attracted his attention.

M. Jonckheere, at the Hem Observatory, was able to see the penumbral shadow, with the naked eye, at 10h. 32m., and observed first contact with the shadow at 10h. 57m. 5s. (M.T. Hem). He also records that the meteorological observations, presumably delicate, indicated a sensible lowering of temperature during totality.

The Probable Errors of Radial-velocity Determinations.—The radial velocities of stars are now being measured by many observers, not always with concordant results, and it becomes important that the probable errors of such observations should be investigated and defined with every care. In a paper in No. 3, vol. xxxii., of the *Astrophysical Journal* (p. 230), Mr. Plaskett deals with this subject, basing his discussion on exhaustive experiments he has made at the Ottawa Observatory. Many factors enter the problem, and one of the most important is the effect of dispersion. Mr. Plaskett finds that, contrary to expectation, the accuracy is not inversely proportional to the dispersion of the spectrograph used, only a

small increase of probable error, say 40 per cent., appearing when the dispersion is divided by three.

In the early-type stars the diffuseness of the available lines in the spectrum increases the probable error very rapidly, and Mr. Plaskett is convinced that physical causes in the star's atmosphere are contributory to this increase.

For solar-type stars it would appear that the average probable error of a good three-prism determination need not exceed ±0·5 km. per sec., while with one prism ±0·70 km. might be expected in good work. If stars of an earlier-type spectrum are dealt with, ±2 to ±11 km. per sec. is a moderate estimate of the probable error. Finally, Mr. Plaskett suggests that with solar stars the greater part of the error accrues from instrumental causes, the errors of measurement only accounting for about one-third or less.

THE PHOTOGRAPHIC MAGNITUDES OF STARS.—In Circular No. 160 of the Harvard College Observatory Prof. E. C. Pickering discusses the progress made, to July, in the establishment of a method for determining photographic magnitudes and of a scale for recording them.

Three methods have been found to give satisfactory results. The first depends upon the law that stars of the same spectral class have the same colour and has been tested with concordant results; the following values are interesting as giving the constants necessary to reduce photometric to photographic magnitudes according to spectral class:—

B	A	F	G	K	M
−0·31	0 00	+0·32	+0·71	+1·17	+1·68

Thus if the visual magnitude of a star is 5·00 and the spectrum is of type B, the photographic magnitude is 4·69, but if the spectrum is of the G type the photographic magnitude is 5·71.

The second method, in which a standard "polar sequence" of stars is photographed on the same plate and under similar conditions as the stars to be measured, has been already described in these columns, but it is interesting to note that the work has been extended to stars so faint as the twentieth magnitude, and it is hoped, ere long, to publish definitive magnitudes for a great number of stars in both hemispheres. About 11,000 measures of 200 photographs have already been made; for stars fainter than magnitude 14, for which long exposures are necessary, it has been found that this method is not so suitable. For such stars it has been found that the third method, in which a small circular prism of very small angle is attached to the centre of the objective, is better; the small prism diverts a known proportion of the light from each image into a secondary image, and so provides a ratio scale. Prof. Pickering discusses the difficulties presented by the problem, and states that although the results already attained are very hopeful, much remains yet to be done.

The same problem is also attacked by Herr E. Hertzsprung in No. 4452 of the *Astronomische Nachrichten*, who proposes a tried method in which the density of a direct image is compared with an image, on the same plate, produced when a grating is placed before the objective.

PROPER MOTION OF THE STAR B.D.+33° 99.—Whilst making observations of the minor planet 1910 KU, Dr. Abetti was led to suspect that one of his comparison stars, B.D.+33° 99 (AG. Lei. 226), has a large proper motion. Subsequent investigation and calculations show that this proper motion amounts to −0·027±0·004s. and −0·34±0·00″. The magnitude of this star is 8·5 (*Astronomische Nachrichten*, No. 4453).

THE NEW METEOROLOGICAL OFFICE.

ON Thursday, December 1, a large party assembled at the new Meteorological Office at the corner of Exhibition Road and Imperial Institute Road on the invitation of the Meteorological Committee.

The committee was originally appointed by H.M. Treasury in 1905 to control the administration of the Parliamentary grant for meteorology. Its inexpressive title gives little indication of its responsibility to the country and, indirectly, to the world at large. It consists of the director of the office, Dr. W. N. Shaw, who is *ex officio* chairman; the hydrographer of the Navy, Rear-Admiral H. E. Purey Cust; Mr. G. L. Barstow, of the Treasury; Captain J. M. Harvey, of the Board of Trade; Mr. T. H. Middleton, of the Board of Agriculture and Fisheries; with Sir G. H. Darwin, F.R.S., and Prof. Arthur Schuster, F.R.S., the nominees of the Royal Society.

The work of the office goes back, in continuity, to the original establishment of a Meteorological Department of the Board of Trade for the joint service of the Navy and the mercantile marine under the superintendence of Admiral FitzRoy, the naval officer who, as captain of the *Beagle*, had carried Charles Darwin round the world. The motive power for the establishment of a special department for meteorology came from a maritime conference held in Brussels in 1853, in which Lieut. Maury, of the United States Navy, a well-known geographer and meteorologist, took a leading part. The primary object of the office was the collection and discussion on an organised plan of meteorological observations made at sea; but when Leverrier began collecting daily observations by telegraph in France, FitzRoy associated himself with the idea, and in 1860 he introduced a system of weather telegraphy with storm warnings and forecasts which in 1861 were published in the newspapers.

This line of action evoked a great deal of criticism on the part of scientific authorities, and it is doubtful whether meteorology, at that time a bashful *débutante* among the sciences, has ever been forgiven for so shocking a *faux pas*. It is true that the system of warnings was continued after FitzRoy's death at the instance of the Board of Trade, influenced by several memorials to Parliament, and that in 1879, after the issue of forecasts had been dutifully suppressed for twelve years, in a report of the council then in control of the office, appointed by the Royal Society and made up of the great names of Henry J. S. Smith, Warren De la Rue, Frederic J. O. Evans, Francis Galton, George Gabriel Stokes, and Richard Strachey, the following paragraph appears:—"For several years forecasts not intended for publication had been daily prepared in the office, and the experience thus gained by the staff has emboldened the council to announce their readiness to commence in April, 1879, the issue to the public of forecasts for the different parts of the United Kingdom," and that the issue has been continued ever since; but the natural hesitation which men of science feel about publishing their conclusions before they have had an opportunity of verifying them has always overshadowed that side of the office work. To that circumstance, combined with the frigidity with which the young science has been treated by her elder sisters, it is probably due that, while prolonged effort has been devoted to the preparation of forecasts twice, or even three times a day, for a whole generation, and while the rule that no forecast shall be formulated without first setting out the data and the grounds for the inference has been rigorously enforced, yet the issue of the forecasts has been left practically to the newspapers. It seems otherwise inexplicable that no general system of distribution of forecasts by telegraph should have been adopted in this country.

FitzRoy died in 1865, and the office became the subject of inquiry by a Government committee, with the result that in 1867 the control of the Parliamentary grant was handed over to a committee of the Royal Society, with Sir E. Sabine, the president of the Royal Society, as chairman. At the same time provision was made for marine meteorology and weather telegraphy to be associated with the work of fully equipped meteorological observatories of the first order, six of which were forthwith established, namely, Falmouth, Stonyhurst, Aberdeen, Glasgow, Armagh, and Valencia, in addition to Kew, which had become the central observatory of the system.

Continuity between FitzRoy's department and the Meteorological Office was maintained by the transfer of all the duties of the department and a number of members of the staff to the new committee. Mr. T. H. Babington, however, who took over the management of the department on FitzRoy's death, was not transferred; Mr. R. H. Scott was appointed director of the new establishment with